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(71) Applicant

Carb-a-Drink International (USA-Utah),  
57 West 200 South, Suite 507, Salt Lake City, Utah  
84101, United States of America

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(72) Inventor

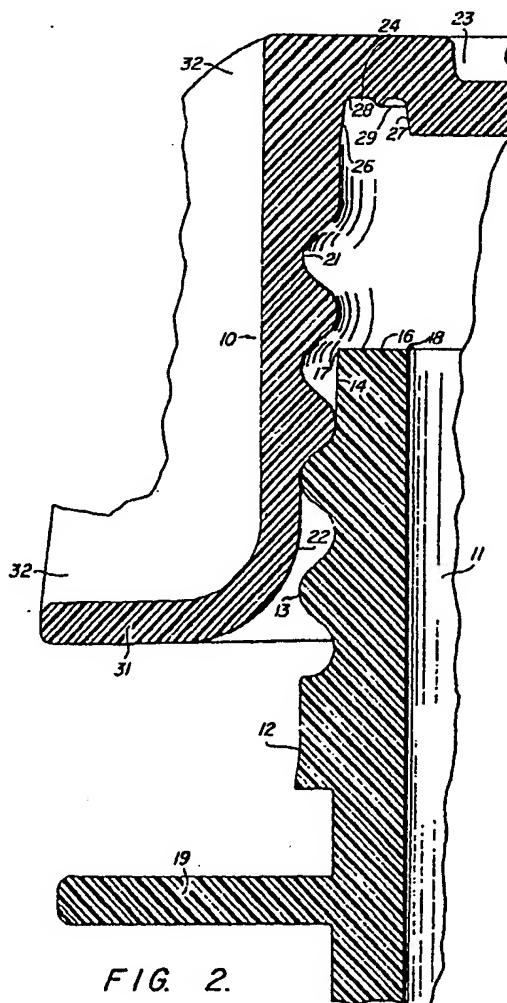
William H Lichfield

(74) Agent and/or Address for Service

Haseltine Lake & Co,  
Hazlitt House, 28 Southampton Buildings, Chancery  
Lane, London WC2A 1AT

(54) Reusable screw-on bottle cap  
for gastight seal

(57) A cap (10) for closing the neck of a bottle (11) comprises an inside thread (21), and an annular groove (24) in the bottom of the cap in position to receive the circular top edge (16) of the bottle neck. The groove (24) is defined by a bottom (28) and slanted side walls (26,27) directed inwardly of the groove, and an endless ridge (29) is formed on the bottom adjacent the centre thereof. Vanes (32) assist manipulation of the cap.



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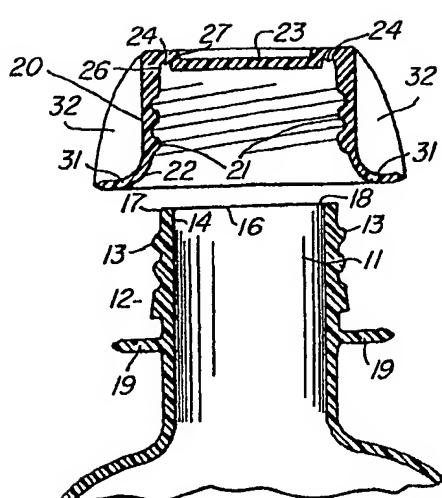


FIG. 1.

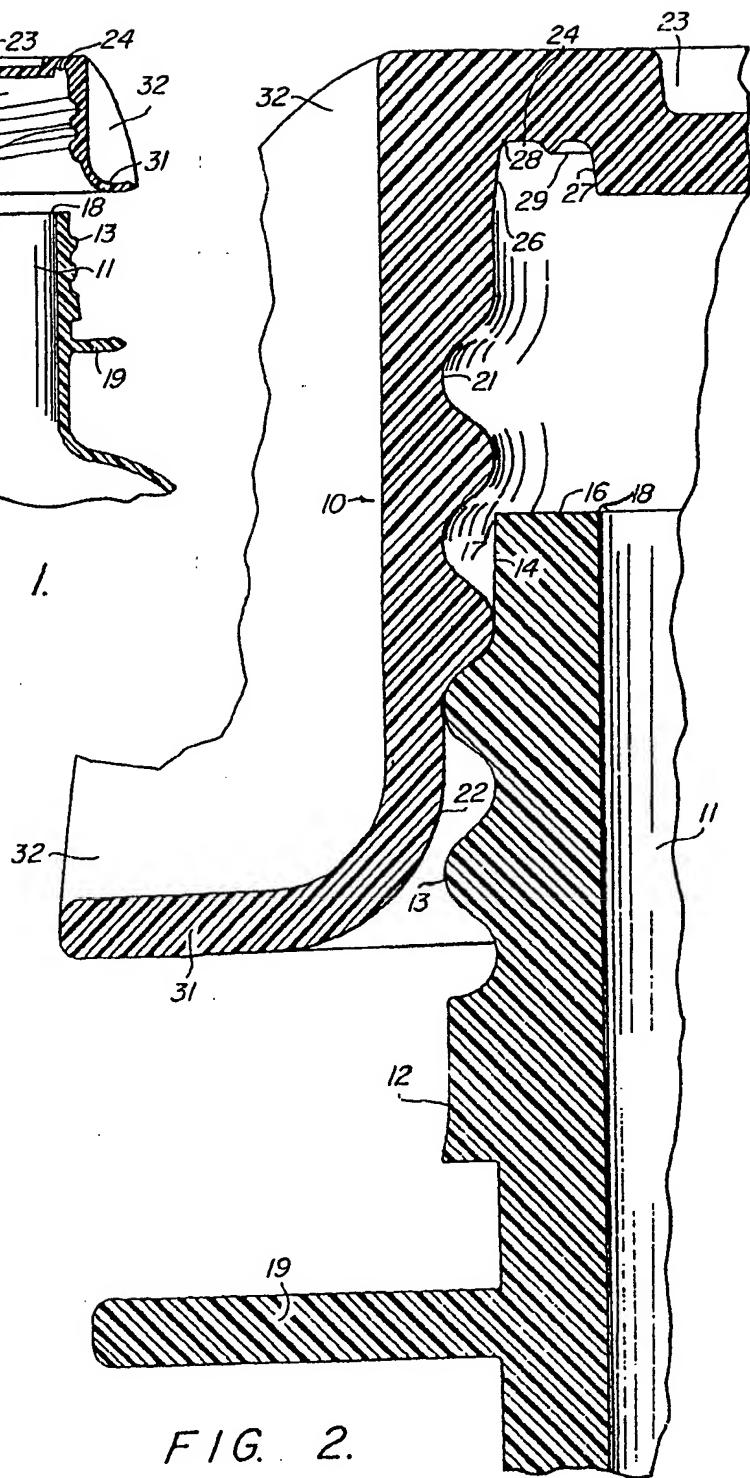
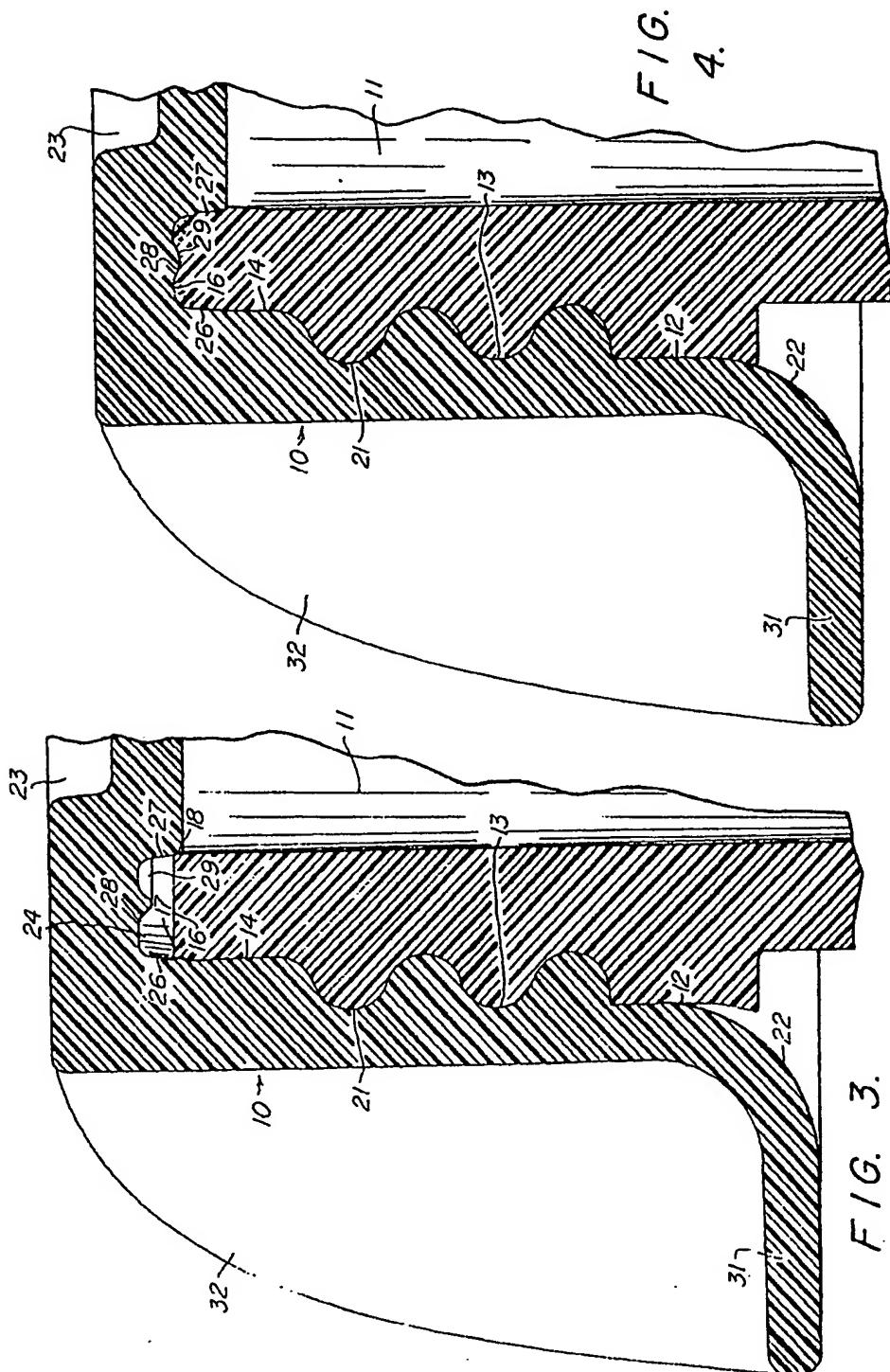


FIG. 2.

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## SPECIFICATION

### Reusable screw-on bottle cap for gastight seal

5 This invention relates generally to liquid containers with screw top closures and in particular to a closure cap for carbonated beverages which may be used many times yet retain the ability to reseal upon each reclosure.

In modern merchandising the trend is increasingly toward bulk takeout sales of food and beverages. In most cases, a suitable takeout container need only be clean and capable

15 of resisting spillage or intrusion by dust, insects or the like. However, in the case of carbonated beverages, special problems exist in sealing against carbonation loss. The lack of a reliable resealable container has been

20 detrimental to the takeout bulk sales. Thus, sales of carbonated beverages have been limited to factory sealed cans or bottles, or individual cups sold for immediate consumption. Further, in the case of large bottles, i.e.,

25 two liter, sold in grocery stores, the screw top initially furnished with the bottle cannot be relied upon to repeatedly reseal the container against pressure loss.

### 30 Prior Art

The typical bottle currently in use has a screw-on cap that depends on engagement by a flat soft liner in the top of the cap with the top flat rim of the bottle neck. This is an

35 adequate seal when the cap is first applied at the bottling plant, but after a few uses the gasket, which is soft, becomes scarred and loses its ability to seal. A typical lined cap is disclosed in United States Patent 2,038,524.

40 Caps have been proposed that eliminate the soft liner, but they include complex structure that result in many crevices in which liquid and bacteria may secrete with the result that it is virtually impossible to satisfactorily sanitize

45 the cap for reuse. Typical of this type cap are those disclosed in United States patents 4,210,251 and 4,360,114.

### Preferred Objectives

50 The present invention seeks to overcome the foregoing problems thereby making bulk purchasing of carbonated beverages in reusable containers economic and convenient.

It is a primary object of this invention to

55 provide a sealing cap that is capable of repeatedly providing a gastight seal on a bottle.

A related object is the provision of a bottle cap adapted to repeatd use on standard existing screw top bottles to provide a seal against pressure losses.

Another object is the provision of a cap of the type described that has a plurality of separate but cooperating sequentially engaging sealing areas that will, upon reclosing,

65 provide a seal against pressure loss despite

breakdown of some of the sealing edges on either or both the bottle or the cap.

A still further object is the provision of a closure cap of the type described that, in addition to the internal threads, is provided with means that cooperates with complimentary means on the bottle to lock the cap in place after it is in sealing position.

Still another object is the provision of a closure cap attaining the foregoing objects that is convenient to use and is easily manipulated by a person's fingers to effect opening and closing thereof.

Another important object is the provision of a closure cap attaining the foregoing objects which is constructed as a single piece without separate gaskets or other sealing elements and thereby is free from cracks or crevices in which bacteria may be secreted. The cap of the invention is therefore easy to maintain in a state of food-grade cleanliness.

### Features of the Invention

The foregoing and other objects of the invention are achieved by a closure cap that is adapted to conform to threads on an existing container to be screwed thereon for closing the same. The inner end of the cap has an inwardly (axially) facing annular groove ar-

95 ranged to accept the top edge of a bottle neck. The sidewalls of the groove are curved from the top inner surface thereof and converge toward each other and the base of the groove. The base or bottom of the annular

100 groove is provided with a centrally located endless ridge that will engage the top edge of the neck of the bottle when the cap is screwed on sufficiently far.

The width of the groove must be slightly less than the thickness of the wall of the bottle on which the cap is screwed. Thus, on initial closing the tapered wall of the groove will contact the top edges of the bottle neck thus providing two endless primary seal lines, one on each side of the top edge of the bottle neck. The tapered walls also center the top surface of the neck into optimum position for engagement by the endless ridge when the cap is screwed down far enough.

115 The cap of the invention thus provides three separate primary seal zones, one on each side of the top edge of the bottle neck and the third one on the top central surface of the bottle neck. Of course there is also the sealing effected by conformance of the cap and bottle surfaces:

The third seal line may not be needed in all cases, but does become increasingly effective as the top edges of the neck or the walls of the annular groove become worn whereby the cap screws down further for sealing. If desired, the cap can at any time be screwed down far enough to engage the center seal ridge. This, however, may not be necessary so long as the side seals are firmly engaged.

- To assist in locking the cap in said position, a section of smooth nonthreaded inner wall is provided in the cap base between the end of the threads and the entrance to the cap. This smooth wall portion comes into face-to-face contact with a complimentary ring on the bottle neck below the threads. The resulting frictional engagement helps to hold the cap against inadvertent loosening.
- 10 To facilitate use of the cap by a person's fingers, blades or wings are provided on the outside of the cap body.

In order that the invention may be more readily understood and carried into effect, reference is made to the accompanying drawings and the description thereof which are offered by way of illustration only and not in limitation of the invention, the scope of which is defined by the appended claims and equivalents embraced therein rather than any description thereof.

#### THE DRAWINGS

In the drawings:

- 25 Fig. 1 is a sectional view of a cap and the neck of a bottle.  
 Fig. 2 is a side sectional view of a cap embodying the invention, the cap being shown in place on the neck of a bottle, with  
 30 the cap approaching the initial seal position. For clarity an enlarged partial view is used.  
 Fig. 3 is a view similar to Fig. 2, but with the cap threaded further onto the bottle and in the initial seal position.  
 35 Fig. 4 is a view similar to Fig. 2 and 3 but with the cap in the most advanced sealing position.

#### DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings:

The invention is illustrated as embodied in a cap 10 which is suitable for use with a typical bottle 11.

- 45 The usual bottle includes a body tapering to a neck having a cylindrical smooth wall section 12 followed by threads 13 and terminating in an outer cylindrical section 14 at a flat top rim surface 16 that is bounded by an  
 50 outer sidewall edge 17 and an inner sidewall edge 18. An annular flange 19 extends from the bottle below the neck to facilitate handling.

The cap 10 of the invention comprises a  
 55 cylindrical body or cup 20 with internal threads 21 and a smooth wall portion 22. The cap has a closed top 23 on the inside of which is an axially facing annular groove 24 defined by outer and inner tapered walls 26  
 60 and 27 and a bottom 28 on which is formed an endless ridge 29 spaced between the sidewalls.

An annular flange 31 extends outwardly from the base of the body substantially  
 65 transverse to the axis. A plurality of wings 32

assist in turning the cap with the fingers for closing or opening the container. The wings connect along their edges to the cap barrel and the flange to provide rigidity.

- 70 The important seals against pressure loss are provided by the unique construction of the cap, in particular, the groove 24 with its tapered sidewalls 26 and 27 and the ridge 29. The functional relationship of the elements is shown in Figs. 1-4. As the cap is screwed onto the neck, the top portion 16 of the neck enters the groove between opposite sidewalls 26 and 27. As the cap is screwed further into the bottle, seals are formed between the walls and neck as the parts come into contact. The tightness of the seal is increased as the cap is screwed down and the curvature between the inner top surface of the cap and the inner walls of the cap engage the neck portion. As the neck portion is moved into the groove it is centered over the ridge 29. If cap tightening continues, the top neck rim 16 engages the central ridge. Thus, in accordance with the invention, there are provided three seals: one on each side of the neck rim, and one on the top. The ridge 29 does not extend the full depth of the groove. Also, a bottle neck rim may not initially enter the groove in the center. The tapered sidewalls will first engage the rim and center it, if necessary. Thereafter the ridge 29 will be contacted by the rim.

To achieve full benefit of this invention the width of the groove for most of its depth must  
 100 be less than the wall thickness of the sealing edge of the bottle neck. Dimensioning this way insures that there will be two initial pressure-seated seal lines, as described, as well as a third pressure-seated line when the  
 105 cap is screwed on further.

Stated another way, for sealing a bottle having neck wall of known thickness X, the groove should taper inwardly from an entrance width of about X to a lesser bottom width. Although the dimensions are small, the change in width may be significant on a proportional basis.

The usual bottle is a flexible plastic so that as the neck is squeezed between the groove walls 26 and 27 the plastic is in effect extruded or displaced toward the ridge 29, thus engaging it more quickly and firmly and improving the seal. Also, the ridge 29 will dig into the rim and in turn displace the plastic laterally toward both sides of the groove, thereby increasing the pressure-seating on the seal lines.

The multiple seal line arrangement is important because it accommodates wear in the neck due to frequent opening and closing. Also, minimal rotation of the cap simultaneously increases seal forces in all areas.

As a further precaution against inadvertent loosening of the cap, the cap body is provided  
 130 with an inner smooth wall section 22 between

the mouth and threads. This wall section is sized empirically to fit snugly in face-to-face relationship with the smooth wall ring 12 at the base of the threads on the bottle neck.

5. The frictional engagement between the surfaces, which is not necessarily continuous, provides an additional lock against loosening of the cap. To provide this relationship, the surface of the smooth wall section of the cap 10 will be in line with the roots of the threads while on the bottle, and the surface of the smooth ring will be in line with the tops of threads.

The design of the cap enables it to be 15 formed as a one-piece unit. No gaskets are used. There are no small crevices; and even the threads are coarse and rounded, thus, enabling easy washing of the cap for reuse. The cap and container may be made of any 20 suitable material, which should be selected for ease of sanitizing. Since the sealing function is enhanced by some deformation of one element by squeezing, as when the neck is squeezed between the tapered groove walls in 25 the cap, it is desirable that there be a difference in the durometer of the parts. That is, the cap should be harder and less deformable than the bottle neck. Typically, it will be rigid plastic or metal, and it has been found that a 30 cap made of polyethylene material and a bottle neck made of a polyester material will provide a tight seal while having sufficient lubricity to permit easy turning of the cap until it is gas tight.

35 Although a preferred form of my invention has been herein disclosed, it is to be understood that the present disclosure is by way of example and that variations are possible without departing from the subject matter coming 40 within the scope of the following claims, which subject matter I regard as my invention.

#### CLAIMS

- 45 1. A bottle cap comprising an inside threaded cup adapted to fit over the top of a bottle neck, an annular groove in the bottom of said cup in position to receive the circular top edge of a bottle neck, said groove being 50 defined by a bottom and slanted sidewalls directed inwardly of said groove, and an endless ridge on the bottom of said annular groove adjacent the center thereof.
2. A cap according to Claim 2 in which the 55 threads are formed on the inner wall of said cup in a manner to leave between said threads and the open end of said cup a smooth unthreaded wall portion, the surface of which is aligned with the roots of said 60 threads.
3. A cap according to preceding Claims 1 or 2 with the addition of a plurality of vanes 65 cured and extending radially from said cap to enable manipulation by the fingers of a hand.

4. A cap according to preceding Claim 1 in which said ridge extends above said bottom of said annular groove a distance less than the depth of said groove.
- 70 5. A cap for sealing a given bottle having a threaded neck terminating in a circular rim of known wall thickness, said cap comprising a one-piece cup with internal threads adapted to screw onto said given bottle, an inwardly 75 axially facing annular groove in said cap essentially facing said circular rim when said cap is on said given bottle, said groove being defined by a bottom and sloping sidewalls and at its open end being of a width about 80 the same as said known wall thickness of said given bottle and at its bottom being of a width significantly less than said known thickness, and an endless upstanding ridge is formed on the bottom of said groove adjacent 85 the center thereof and extending from said bottom to terminate below the top of said groove.
6. A cap according to preceding Claim 5 in which the threads are formed on the inner 90 wall of said cup to leave a smooth wall surface between the mouth of said cup and said threads and said threads extend radially inwardly of said cup beyond said smooth wall surface.
- 95 7. A cap according to claim 1 and substantially as hereinbefore described with reference to, and as shown in the accompanying drawings.

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